INTRODUCTION

• White matter hyperintensities (WMH) are the most common neuroimaging feature of cerebral small vessel disease.
• They are associated with lacunar stroke, dementia and cognitive impairment\(^2\)-\(^3\).
• Increasing volume of WMH predicts poorer cognition\(^1\), but the association is inconsistent\(^1\),\(^4\).
• Development of voxel-based analysis methods has allowed study of the impact of WMH location.
• Previous research suggests the location of WMH may significantly affect cognition, especially frontal regions, but the data is limited\(^4\).

QUESTIONS

1. Does the location of WMH significantly predict cognitive impairment?
2. Is WMH presence in specific white matter tracts more important for cognitive impairment?

METHODS

WHO?
Sample from the ADNI database\(^5\) of 599 elderly participants split into:
- cognitively normal (n=191)
- cognitively impaired (n=408).

IMAGING
MRI FLAIR and T1 images were used to create WMH lesion binary maps (lesion present or absent in a specific voxel) (figure 1).

COGNITION
Montreal cognitive assessment (MoCA) scores used to identify cognitive impairment.

STATISTICAL ANALYSIS

VOXEL-BASED ANALYSIS
(all participants (n=599))
• Participant binary maps multiplied by a MoCA z-score (adjusted against the mean for cognitively normal group).
• Mean weighted z-score for each voxel of all participants produced an overall cognitive risk map (figure 2).

TRACT-BASED ANALYSIS
(only cognitively impaired (n=408))
• Independent variable: white matter tract percentage WMH occupancy (26 tracts).
• Dependent variable: MoCA score.
• Covariates: age, gender, education, amyloid status, APOE, grey matter volume and total WMH volume.

RESULTS

WMH binary lesion maps according to cognition

Both groups WMH percentage frequency look remarkably similar. Bilateral frontal regions are affected and those nearest the lateral ventricles.

Voxel-based analysis

Superior longitudinal fasciculus

Out of 26 tracts tested, WMH in the superior longitudinal fasciculus significantly negatively impacted MoCA score, independent of covariates. No other tracts had a significant negative association with cognition.

CONCLUSIONS AND FUTURE DIRECTIONS

1. Frontal WMH appear particularly important in terms of impact on cognition.
2. The superior longitudinal fasciculus (SLF) may be a critical tract for cognitive impairment if affected by WMH, which agrees with previous work\(^6\). The SLF is proposed to be the main cortico-association fibre in the brain\(^7\) and may therefore be important for maintaining higher level cognitive function.

REFERENCES


Faculty of Biology, Medicine and Health www.bmh.manchester.ac.uk